Chemical & Engineering NEWS

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1983 ACS award winners Page 44

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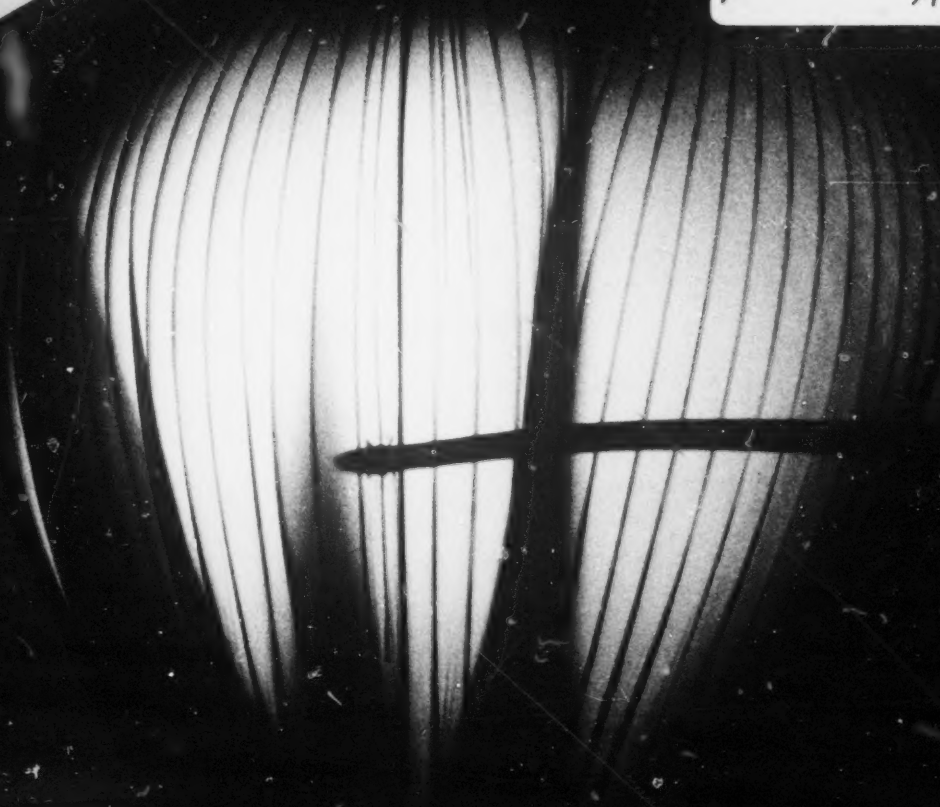

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Stratospheric chemistry

Systematic research replaces crisis response Page 21

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Chemical & Engineering NEWS

Cover: National Center for Atmospheric Research balloon, made of polyethylene and expandable to 15.4 million cu ft at float altitude, is prepared for launch carrying cryogenic whole air sampler. Photo by NCAR's Ginger Wadleigh

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CHEMICAL INDUSTRY TOPS IN EXECS' SALARIES

Top executives in the chemical industry lead the list of average total compensation in 27 industries, according to the latest executive compensation study by Arthur Young & Co., a New York City-based accounting firm.

The study, conducted for the Financial Executives Institute, analyzed the pay in 1981 of about 16,500 top executives of more than 1600 companies in 27 industry groups, and in all seven regions of the country. One of its major conclusions: The highest paid top executives are those in the chemical industry, earning an average annual total compensation of $190,319. That topped executives in the petroleum industry, and even those in the communications industry, which usually is associated with show-biz glamor and lavish compensation packages.

Among other conclusions of the study was that the rate of increase in executive compensation was slowed in 1981 from that of 1980 by lower inflation and declining profits. Pay in U.S. corporations increased only 13% on average, down slightly from a 14% average increase in 1980.

Moreover, the study predicts that the rate of increase will decline further this year. Compensation increases tend to lag behind economic conditions, says James A. Giardina, a partner in Arthur Young. Thus, the full impact of 1981 economic results on executive compensation will be realized this year.

This may well lower average total compensation in industries that were hit harder by the recession in 1981 than in 1980. And it possibly might affect the geographic variations that the study picked up, as some areas are hurting more from the recession than others. Top executives working in the Northeast region of the U.S. earned the highest average total compensation, $147,890, which was up 14% from the 1980 average. The Central States region was second, at an average $128,703—but it had the highest average increase. The Rocky Mountain sector had both the lowest average total compensation—$88,501—and the lowest increase, 9%.

Top executives, however, should be forewarned, according to Edwin S. Mruk, a copartner in Arthur Young. Because "executive pay in more than 75% of U.S. corporations is related directly to corporate performance," in many companies that have performed poorly executive pay has been frozen or cut.

Chemicals and oil execs are best paid . . .

Industry	1981 average annual executive compensation
Chemicals	$190,319
Petroleum	172,550
Communications	166,874

. . . far surpassing those in lowest-paying industries

Life insurance	103,843
Commercial banking	101,012
Real estate	96,437

Source: Arthur Young & Co

And corporate performance will be increasingly important, Giardina predicts. "There is no doubt that companies are placing less emphasis on base salaries and markedly greater emphasis on variable forms of compensation," he says. "The increase in base salaries will lag behind the increase in inflation, and more and more of an executive's total compensation will vary according to performance."

Compensation forms other than salary—such as bonus—are displaying rates of increase significantly higher than those of salary, the study points out. Indeed, bonuses are probably one reason for the chemical industry's rating as high as it does, because of a skewing from such generous grants as the million-dollar bonus W. R. Grace voted its chairman, J. Peter Grace, for 1981. But by the same token, the industry next year well may reflect the salary freezes that chemical companies have put into effect this year. Du Pont and Dow Chemical, for example, have put temporary freezes on salary increases for management and professional employees. □

Pentagon blocks papers at scientific meeting

After a mere reading of titles and abstracts and an in-depth review of about 12 papers, Pentagon officials informed authors of some 100 unclassified scientific papers that their deliverance at an international conference on optical engineering held late last month could violate export-control laws. These authors, Defense Department employees or contractors, withdrew the papers, and by doing so helped set a precedent. Never before has the government caused such a large number of papers to be blocked for not meeting so-called International Traffic in Arms Regulations, or ITARs.

This massive withdrawal deprived attendees (many of them foreigners and several of them from the Soviet Union and other Eastern Bloc nations) at the 26th Annual International Technical Symposium of the Society of Photo-Optical Instrumentation Engineers (SPIE) of fully 13% of the technical material that would have been presented in the some 750 papers listed. All of the withdrawn papers reported on applied research, which one Pentagon official, who asks not to be named, terms "sensitive, defense-related technical information."

These national-security-sensitive papers covered such topics as optical and electrooptical engineering (lasers), high-speed videography, infrared technology, airborne reconnaissance methods, and what the official calls battlefield "obscurance" (smoke) techniques. He says DOD "took extraordinary efforts to head off this potential security disaster," because release of the data would have assisted the Soviets "in the development of things that could be used against us." On the other hand, this official claims that submitted Eastern Bloc papers, which focused on sports medicine and high-speed photography, contained information of little military utility.

SPIE technical director Charles Batishko says his society will work with the government "to assure that a similar situation need not occur again." In fact, many of the withheld papers will be taken through the clearance procedure required by the DOD regulations and may be

Aerosols slowly making a comeback

Outlook brightens as new raw materials contend for role as propellants following fluorocarbon controversy over stratospheric ozone

Patricia L. Layman
C&EN, New York

The aerosol industry has had a lot to contend with over the past decade or so. Countless critics prepared its obituary after the formulation of the ozone-depletion theory by F. Sherwood Rowland and Mario J. Molina (see page 21), taking potshots at the ubiquitous but humble can, which had a market of nearly 3 billion units yearly.

But the industry has confounded many of its critics, proving exaggerated the reports of its demise: Slowly, slowly, it is making a comeback, coping with legislation on environmental and safety grounds. New raw materials are contending for roles as propellants, both in traditional technology and new developments.

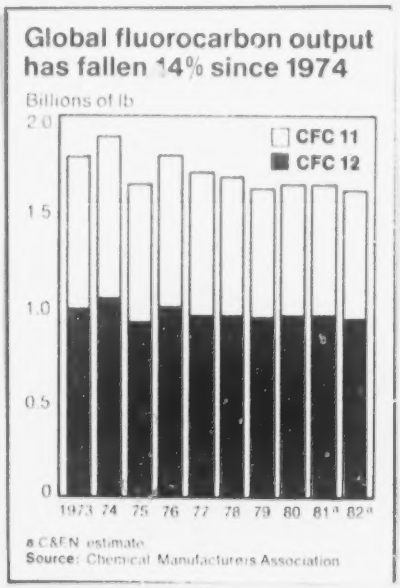
And even the latest problem with which it has had to contend—the problem of flammability in large-volume storage—seems to be controllable. If industry studies are accurate, moreover, the designs for protecting against large-scale aerosol fires may prove more efficient, cost-effective systems for use in general fire-safety applications.

Aerosols had built a market of nearly 3 billion units by 1973. Growth was still smart, probably nearly 10% per year, although many industry marketers predicted at the time a falling off of growth. The two principal market segments—deodorants and antiperspirants, and hair sprays—were reaching saturation points. The worry at the time was where the next big-volume products would be found.

Unfortunately, before those new product areas were stumbled upon, the aerosol industry stumbled over the ozone depletion theory. The theory was fertile ground for joking columnists. It also accounted for a 6.2% drop in sales of aerosols, from 1973 to 1974, as production dipped to 2.72 billion units. Many consumers took the message seriously.

Many swore off aerosols completely, oblivious to chlorofluorocarbons' being the propellants in only about half the aerosols produced. Sales continued to drop—down 13.5% in 1975, down 2.6% in 1976, down another 6.3% in 1977. Those were the official statistics issued by the Chemical Specialties Manufacturers Association; other sources contend that the drops were even more severe.

CSMA surveys indicated a pickup in business again in 1978 and 1979, only to be followed by a nearly 10% decline in production in 1980—the year after the use of chlorofluorocarbons as propellants for aerosols was banned by the federal government. Personal products—for example, hair sprays, deodorants and antiperspirants, perfumes and colognes—was the major category that used chlorofluorocarbon propellants. Many marketers of personal products, which rely heavily on glamor and image advertising, disliked getting involved with something "petroleum-based" (never mind how chlorofluorocarbons are produced) or with the undeniable flammable nature of hydrocarbon propellants. And some consumer-product marketers were convinced that, despite the highly refined grades of propane, butane, and isobutane being used for propellants, there was still a residual odor that mingled with the scent of the product. It might be acceptable for a spray paint or furniture polish, but not for a fine perfume, the argument went. So many marketers took the easy way out: They abandoned aerosols altogether, turning to such alternative products forms as pump sprays, solid sticks, and regular creams and liquids.



Over the past two years, however, the industry has been struggling back. CSMA and the National Paint & Coatings Association (NPCA), the two industry trade associations with a heavy interest in aerosols, have sponsored programs to promote the aerosol as a handy, safe package.

And after a wrenching change to hydrocarbon propellants, among those manufacturers who did change, things have settled down to the point that hydrocarbons now account for probably 98% of all aerosols filled. Chlorofluorocarbons are used for some special-exemption categories, primarily for Food & Drug Administration-approved medicinal purposes.

Probably about 60% of the hydrocarbon propellants is isobutane, with propane the next most widely used, with 25%, and *n*-butane the remainder. Rarely is one hydrocarbon used alone; product developers seek to tailor a pressure particularly for their product, and that is generally best achieved by a blend of two or more propellants.

Hydrocarbons originally began moving into the aerosol market as competitors to chlorofluorocarbons because of lower prices. But along with that advantage, manufacturers had to cope with the marked disadvantage of their flammability. This could be a particular problem, of course, when the product itself in addition to the propellant was flammable—alcohol, perhaps—or when the spray might be dispensed around an open ignition source—hair spray applied while a person was smoking a cigarette, for example.

The answer, on an individual-product level, seems to be methylene

chloride, which acts as a flame suppressant at a concentration of about 15%. But on an aggregate level, it is another problem completely, and that issue has become the latest assault on the industry.

Fire departments and insurance underwriters worry about the dangers if fire occurs in a warehouse stocked with large numbers of various aerosols. It's not an idle concern: The industry is well aware of several warehouse fires over the past few years that have involved aerosols.

Factory Mutual, an insurance company, several years ago became concerned about the potential of explosions, hydrocarbons contributing to fire spread, and other dangers. For a time, at least, it appeared a distinct possibility that aerosols would be severely restricted as to what kinds of storage would be acceptable to underwriters.

However, studies conducted by Factory Mutual, CSMA, and NPCA have come up with several recommendations that many in the industry believe could lead to more effective safety standards for general warehousing. Among the major recommendations is the need for lower ceilings so that sprinkler heads would be nearer any point of fire, and a more sensitive sprinkler head, with linkages actuating at 165 °F rather than the 286 °F that Factory Mutual now approves. That gives spot control where it is needed.

Even if such warehousing improvements are made over the next few years, however, other propellant suppliers feel the more immediate way to answer the problem is to do away with it. Grow Group's Enviro-Spray aerosol system, for example, works by carbon dioxide pressure, but in a totally different means than the compressed carbon dioxide that has been promoted to the aerosol industry with little success.

And suppliers are beginning to offer highly purified, aerosol-grade lines of dimethyl ether, a propellant used for years in Western Europe and Japan, as an alternative. It can be formulated with high concentrations of water—as high as 50% in some formulations, one supplier says—which not only lessens the problem of flammability but may even open some new opportunities.

Fluorocarbon producers are nearing the end of various tests on fluorocarbon 142b and 22, and preliminary results seem promising for their use as aerosol propellants. Another chlorofluorocarbon, CFC 152a, already is used commercially in one-shot insecticides, the kind set off in a room and allowed to empty totally.

In the meantime, however, hydrocarbon producers are paying attention to their basics, keeping distribution running smoothly, and hoping for new product introductions to spur growth.

One supplier says, "This year, if we see 2 to 3% growth, it'll be pretty good." The recovery will help, whenever it arrives, "because of inventory adjustments. For the past two years, inventories have been at rock bottom," he adds. The resulting replenishment period will cause as much as a 5% growth. However, over the long term, he sees a conservative average growth of 2 to 2.5% a year.

To jazz up those numbers, some marketers feel, will require the introduction of dramatic new products, "to capture the public's attention or interest." Says one, "We need something to take the place of high-volume, daily use items: like hair sprays and antiperspirants." Automotive products, for example, grew 20% from 1980 to 1981—but only to 204 million units filled. "The growth rates look beautiful, but the bases are so small," he adds. "Everyone is looking for that big new product."

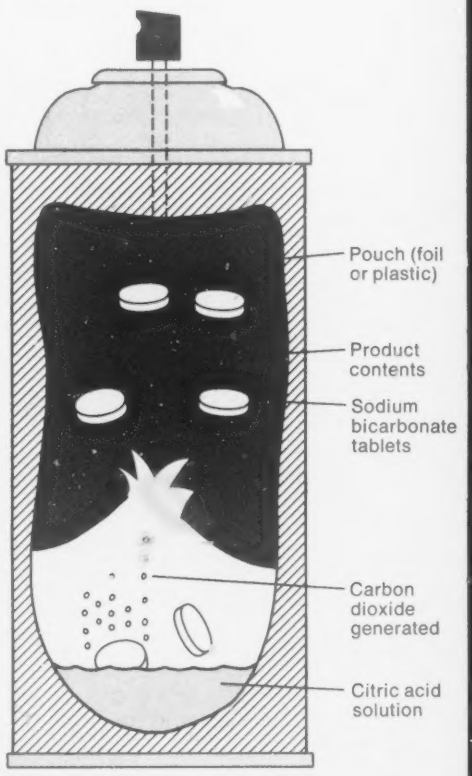
Until that big new product is found for the aerosol industry, it will be a long, slow climb toward recovery. But for an industry once counted out, maybe that's not so bad after all. □

Newest aerosol features in-situ CO_2 generation

One of the newest developments in aerosols is Grow Group's "Enviro-Spray" unit, which depends on in-situ carbon dioxide generation. The technology has been around for a number of years, and had a fitful start when Grow, a New York City-based coatings maker, first began promoting it in late 1979. Since then, however, the company has invested time and money in improvement work, and some aerosol industry consultants say the technology finally is beginning to look promising.

As originally patented (U.S. 3,718,236) the technology featured a plastic pouch filled with small compartments containing sodium bicarbonate tablets. Citric acid solution was in the bottom of the pouch, and a small amount of carbon dioxide was charged under pressure into the pouch as a starter propellant. When the product first was dispensed, the carbon dioxide expanded, rupturing the lowest compartment membrane, dropping the bicarb tablets into the citric acid. That generated carbon dioxide, giving more pressure to the pouch, which would expand and help push out more product.

According to David Magid, president of Enviro-Spray Systems, the Grow subsidiary that markets the product, the basic chemistry remains the same, but the product has been modified. The company won't show schematics of the new model, on which it has five patent applications. But they all contribute to making the product an "easier and more accurate gas-producing vehicle," he says. The company has developed a system, he adds, enabling present aerosol production and filling equipment to be used with the product—a crucial point to selling the concept to potential customers, who would be loath to adopt a technology requiring major capital investment.



Grow already is marketing an insecticide for indoor-outdoor plants and has plans for other products. Magid sees, for example, potential markets in such products as caulking compounds, and 1-gal insecticide containers, as well as more conventional markets in personal care and household products, pharmaceuticals, and food products. Most of the company's marketing of products is, in effect, an attempt to show off its technology; as Magid notes, "We are not trying to get into particular competition with other marketers who may be possible competitors."